PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-302033
(43)Date of publication of application : 28.10.1994

(51)Int.Cl. G11B 11/10

(21)Application number : 05-084819
(22)Date of filing : 12.04.1993

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(54) REPRODUCING METHOD FOR MAGNETO-OPTICAL RECORDING MEDIUM

(57)Abstract:
PURPOSE: To obtain a method by which a reproduction is performed with a smaller cross talk by using a FAD system simplifying the manufacture of a medium and obviating an initialization magnet.
CONSTITUTION: The reproduction of signals is performed by using a magneto- optical recording medium in which the inter-code interference of signals at the time of reproduction is much more reduced than a normal reproduction by erasing temporarily the recording in a part when a medium temperature is raised up to a temperature higher than a specified temp. by a reproducing light and by starting again the recording when the temp. is lowered. In such a case, a track having information is reproduced with the reproducing light by irradiating, with an auxilliary light, a track on one side or tracks on both sides being adjacent to the track having information to be reproduced while erasing signals on the adjacent tracks with its heating.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] When a temperature up is carried out more than the temperature of specialization [medium temperature] by regeneration light, record of the fraction is once eliminated, temperature falls and record appears again [when reproducing a signal using a magneto-optic-recording medium by which the intersymbol interference of the signal at the time of regeneration is reduced rather than usual regeneration] The regeneration technique of the magneto-optic-recording medium characterized by reproducing the truck which has an information by regeneration light, irradiating supplementary light on the truck of one side which adjoins the truck which has the information reproduced, or both sides, and eliminating the signal of the above-mentioned adjoining truck by the heating

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention relates to the regeneration technique of a magneto-optic-recording medium.
[0002]
[Description of the Prior Art] The magneto-optic-recording medium is put in practical use as a high density and an information record medium which can rewrite a low cost. Especially the medium using the record layer of the amorphous alloy of rare earth elements and transition metals shows the property which was very excellent. Although a magneto-optic disk is a very mass record medium, the further large capacity-ization is desired in connection with increase of social amount of information. In a usual case, the recording density of an optical disk will be decided by the size of the spot of the regeneration light.
[0003] Since the size of a spot can be made so small that the wavelength of laser is short, although the study of short-wavelength-izing of laser is advanced, it is accompanied very much by the distress. The attempt of the so-called super resolution technique in which it, on the other hand, obtains the resolution of the more than determined with the wavelength of laser by various devices is performed in recent years. A magneto-optic disk is used for one of them, and the super resolution using the switched connection force between multilayers is reported.
[0004] The medium by which the small regeneration layer of coercive force, the low switching layer of Curie temperature, Curie temperature, and coercive force consist of three layers which carried out switched connection mutually [a high record layer] is used for this method. When it heats by regeneration light, impressing a regeneration magnetic field, switched connection goes out in the elevated-temperature section of a medium. For this reason, a regeneration layer turns to the orientation of a regeneration magnetic field, and a record bit is eliminated.
[0005] Therefore, since only the low-temperature section is reproduced and a regeneration domain becomes narrow as a result, the same effect as the case where regeneration light is extracted is acquired, and regeneration which is a high-density record bit can be performed. The eliminated record bit is revitalized by imprinting from a record layer, when medium temperature becomes low and switched connection is recovered. This method is called Forward aparture detection (FAD) in order to detect a signal by the pars anterior of a regeneration light spot.
[0006] Apart from this, using low coercive force, the regeneration layer of low Curie temperature, high coercive force, and the record layer of high Curie temperature, the regeneration layer is once initialized after record in the initialization magnetic field, and there is also the technique of imprinting record of a record layer in a regeneration layer by the temperature rise of regeneration light. This method is called Rear aparture detection (RAD) in order to detect a signal by the posterior part of a regeneration light spot.
[0007]
[Problem(s) to be Solved by the Invention] Although high-density-izing is possible for both methods, there is no RAD theoretically that the signal from an adjoining truck leaks in order to initialize also except [all] a regenerative track (cross talk), and a track pitch can also be narrowed. However, a medium cost will be made high by performing a control of the switched connection force strictly, in the initialization magnet with a big magnetic field called a number kOe being needed, therefore inserting the control layer of the switched connection force etc.
[0008] Although such problems were not in the technique of FAD, since a cross talk existed, it was difficult to pack a track pitch more narrowly than the present condition.
[0009]
[Means for Solving the Problem] As a result of inquiring that the above-mentioned technical probrem should be solved, this invention person etc. lost the cross talk, even if regeneration light was FAD medium by preparing supplementary light independently, and it found out that it was possible to realize a ** track pitch. When a temperature up is carried out more than the temperature of specialization [medium temperature] by regeneration light, record of the fraction is once eliminated, temperature falls and record appears again, the summary of this invention [when reproducing a signal using a magneto-optic-recording medium by which the intersymbol interference of the signal at the time of regeneration is reduced rather than usual regeneration] It consists in the regeneration technique of the magneto-optic-recording medium characterized by reproducing the truck which has an information by regeneration light, irradiating supplementary light on the truck of one side which adjoins the truck which has the information reproduced, or both sides, and eliminating the signal of the above-mentioned adjoining truck by the heating.
[0010] Hereafter, this invention is explained in detail. As a record medium, the medium conventionally known as a RAD medium is used. For example, protective coats, such as tantalum oxide and a silicon nitride, are prepared on a polycarbonate substrate, on this, the regeneration layer which consists of GdFeCo, the switching layer which consists of TbFe, and the record layer which consists of TbFeCo are prepared one by one, and, finally a protection layer is prepared.
[0011] It is a configuration desirable when stabilizing the mask configuration at the time of regeneration to form the thermal diffusion layer which has the high temperature conductivity which consists of a simple substance of metals, such as aluminum, Cu, Ag, and Au, or an alloy which makes it a subject through a direct or protection layer on a record layer. If a medium is heated to the grade which exceeds the Curie temperature of a switching layer by regeneration light, impressing a regeneration magnetic field when reproducing the above mediums, the fraction from which switched connection was cut will be eliminated by the regeneration magnetic field, and an intersymbol interference will be reduced also in high-density record. In this case, regeneration luminous intensity needs to be an

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Field

[Field of the Invention] this invention relates to the regeneration technique of a magneto-optic-recording medium.

[Translation done.]

Technique

[Description of the Prior Art] The magneto-optic-recording medium is put in practical use as a high density and an information record medium which can rewrite a low cost. Especially the medium using the record layer of the amorphous alloy of rare earth elements and transition metals shows the property which was very excellent. Although a magneto-optic disk is a very mass record medium, the further large capacity-ization is desired in connection with increase of social amount of information. In a usual case, the recording density of an optical disk will be decided by the size of the spot of the regeneration light.

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[Translation done.]

Effect

[Effect of the Invention] By using the regeneration method of this invention, easily [a medium creation], using FAD method where the initialization magnet is unnecessary, it is possible to perform parvus regeneration of a cross talk, and high-density-ization of record can be attained.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Although high-density-izing is possible for both methods, there is no RAD theoretically that the signal from an adjoining truck leaks in order to initialize also except [all] a regenerative track (cross talk), and a track pitch can also be narrowed. However, a medium cost will be made high by performing a control of the switched connection force strictly, in the initialization magnet with a big magnetic field called a number kOe being needed, therefore inserting the control layer of the switched connection force etc.
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MEANS

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[0012] However, by the conventional technique, since regeneration light did not affect an adjoining truck, the reduction of a lump [leak] of the signal from an adjoining truck was not completed. On the other hand, it reproduces in this invention, erasing adjoining record by the same principle as a regenerative track, in order to irradiate supplementary light on an adjoining truck. For this reason, the regenerative signal with a very small cross talk can be obtained.

[0013] In order not to come to the center of a truck strictly in order to raise temperature and to use supplementary light, and to make a cross talk small, it is desirable that the beam spot is larger than regeneration light. Moreover, the center of supplementary light is desirable in order that the direction in the position preceded a little rather than the center of regeneration light may cut down a cross talk efficiently. Supplementary light can be obtained by the technique a diffraction grating divides a beam, and using a laser array like the 3 beam method used for the tracking of the present compact disk.

[0014] Supplementary luminous intensity can eliminate record, and it needs to choose it so that record of a record layer may not be degraded. It is already established now and such techniques about laser can be easily realized by the low cost. It is possible to lose a cross talk easily, without putting a huge initialization magnet into a drive, or using RAD which must control the switched connection force strictly, if this technique is used.

[Translation done.]

EXAMPLE

[Example] Although this invention is explained still in detail with an example below, this invention is not limited to the following examples, unless the summary is exceeded.
On the polycarbonate substrate which has the track pitch of 11.3 micrometers of examples, the 40nm record layer which consists of the 80nm protection layer which consists of SiN, the 30nm regeneration layer which consists of Gd26 (Fe80Co20) 74 (a numeric value is a component rate), the 35nm magneto-optic-recording layer which consists of Tb21 (Fe93Co7) 79, a 10nm switching layer which consists of Gd28 (Fe93Co7) 72, and Dy28 (Fe60
[0016] Record with a frequency of 9MHz was gone by linear velocity of 7m/s to one truck using this medium. Moreover, record with a frequency of 3MHz was performed on the truck of the both sides by the same linear velocity. Next, a regeneration beam is trichotomized and record was mostly reproduced at the same spacing as a truck using the reproducing head located in a line in the orientation perpendicular to a truck. In this case, when a main regeneration light is in a regenerative track, the supplementary light of both sides exists on an adjoining truck. It reproduced by setting up regeneration power so that it might be the power all of whose three beams are 2.4mW. At this time, CNRs of a 9MHz regenerative signal were 46dB and a high value because of the super resolution effect, and the signals by the 9MHz cross talk were 11dB and a low value.
[0017] The same medium as example of comparison 1 example was reproduced with one beam of only a usual regeneration light. Similarly regeneration power is 2.4mW. In this case, although 9MHz CNR showed 45dB and the high value according to the super resolution effect too, the 3MHz signals by the cross talk were 27dB and a high value.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平6－302033

(43)公開日　平成６年(1994)10月28日

(51)Int.Cl.⁵	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ１１Ｂ　11/10		Ｚ　9075－5Ｄ		

審査請求　未請求　請求項の数１　ＯＬ　（全　３　頁）

(21)出願番号　特願平5－84819

(22)出願日　平成５年(1993)４月12日

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(54)【発明の名称】　光磁気記録媒体の再生方法

(57)【要約】

【目的】　媒体作成が簡単で、かつ初期化磁石が不要であるＦＡＤ方式を用いて、クロストークの小さい再生を行う方法を提供することを目的とする。

【構成】　再生光により媒体温度が特定の温度以上に昇温された場合その部分の記録が一旦消去され温度が低下した際にまた記録が現われることにより、再生時の信号の符号間干渉が通常の再生よりも低減されるような光磁気記録媒体を用いて信号の再生を行う場合において、再生される情報を有するトラックに隣接する片側、または両側のトラックに補助光を照射し、その加熱によって前記隣接トラックの信号を消去しながら、情報を有するトラックの再生を再生光により行うことを特徴とする光磁気記録媒体の再生方法

1

【特許請求の範囲】

【請求項１】　再生光により媒体温度が特定の温度以上に昇温された場合その部分の記録が一旦消去され温度が低下した際にまた記録が現われることにより、再生時の信号の符号間干渉が通常の再生よりも低減されるような光磁気記録媒体を用いて信号の再生を行う場合において、再生される情報を有するトラックに隣接する片側、または両側のトラックに補助光を照射し、その加熱によって前記隣接トラックの信号を消去しながら、情報を有するトラックの再生を再生光により行うことを特徴とする光磁気記録媒体の再生方法

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は光磁気記録媒体の再生方法に関する。

【０００２】

【従来の技術】光磁気記録媒体は、高密度、低コストの書換え可能な情報記録媒体として実用化されている。特に希土類元素と遷移金属のアモルファス合金の記録層を用いた媒体は非常に優れた特性を示している。光磁気ディスクは非常に大容量の記録媒体であるが、社会の情報量の増大に伴いさらなる大容量化が望まれている。光ディスクの記録密度は通常の場合、その再生光のスポットの大きさで決ってしまう。

【０００３】スポットの大きさはレーザーの波長が短いほど小さくすることができるため、レーザーの短波長化の検討が進められているが、非常に困難を伴っている。一方、レーザーの波長によって決定される以上の分解能を色々な工夫によって得ようとする、いわゆる超解像技術の試みが近年行われている。その一つに、光磁気ディスクを用い、多層膜間の交換結合力を用いた超解像が報告されている。

【０００４】この方式は、保磁力の小さな再生層、キュリー温度の低いスイッチング層、キュリー温度、保磁力が高い記録層の互いに交換結合した３層からなる媒体を用いる。再生磁界を印加しながら再生光により加熱したとき、媒体の高温部で、交換結合が切れる。このため、再生層が再生磁界の方向を向き記録ビットが消去される。

【０００５】従って、低温部のみが再生され、結果的に再生範囲が狭くなるため、再生光を絞った場合と同じ効果が得られ、高密度の記録ビットの再生を行うことができる。消去された記録ビットは、媒体温度が低くなり交換結合が回復したときに、記録層から転写されることにより復活する。この方式は、信号を再生光スポットの前部で検出するため、Forward aparture detection(FAD)と呼ばれる。

【０００６】これとは別に、低保磁力、低キュリー温度の再生層、高保磁力、高キュリー温度の記録層を用い、記録後一旦初期化磁場で再生層を初期化しておき、再生光の温度上昇により、記録層の記録を再生層に転写する方法もある。この方式は、信号を再生光スポットの後部で検出するためRear aparture detection(RAD)と呼ばれる。

2

【０００７】

【発明が解決しようとする課題】両方式とも、高密度化が可能であるが、ＲＡＤは再生トラック以外も全て初期化を行うため、隣接トラックからの信号の漏れ込み（クロストーク）が原理的に無く、トラックピッチも狭くすることが可能である。しかしながら、数ｋＯｅという大きな磁場を持つ初期化磁石が必要となるうえ、交換結合力の制御を厳密に行う必要があり、そのため交換結合力の制御層等を挿入することにより媒体コストを高くしてしまう。

【０００８】ＦＡＤの方法にはそういった問題はないが、クロストークが存在するため、トラックピッチを現状よりも狭く詰めるのは困難であった。

【０００９】

【課題を解決するための手段】本発明者等は上記課題を解決すべく検討を行った結果、再生光とは別に補助光を設けることにより、ＦＡＤ媒体であってもクロストークを無くし、狭トラックピッチを実現することが可能であることを見いだした。本発明の要旨は、再生光により媒体温度が特定の温度以上に昇温された場合その部分の記録が一旦消去され温度が低下した際にまた記録が現われることにより、再生時の信号の符号間干渉が通常の再生よりも低減されるような光磁気記録媒体を用いて信号の再生を行う場合において、再生される情報を有するトラックに隣接する片側、または両側のトラックに補助光を照射し、その加熱によって前記隣接トラックの信号を消去しながら、情報を有するトラックの再生を再生光により行うことを特徴とする光磁気記録媒体の再生方法に存する。

【００１０】以下、本発明を詳細に説明する。記録媒体としては、従来ＲＡＤ媒体として知られる媒体が用いられる。例えば、ポリカーボネート基板上に酸化タンタルや窒化シリコン等の保護膜を設け、この上にＧｄＦｅＣｏよりなる再生層、ＴｂＦｅよりなるスイッチング層、ＴｂＦｅＣｏよりなる記録層を順次設け、最後に保護層を設けたものである。

【００１１】記録層上に直接、あるいは保護層を介して、Ａｌ、Ｃｕ、Ａｇ、Ａｕ等の金属の単体、あるいはそれを主体とする合金よりなる高熱伝導率を持つ熱拡散層を形成することは、再生時のマスク形状を安定化する上で望ましい構成である。以上のような媒体を再生する場合、再生磁界を印加しながら、再生光によりスイッチング層のキュリー温度を越える程度に媒体を加熱すると、交換結合が切断された部分が再生磁界により消去され、高密度の記録においても符号間干渉が低減される。この場合、再生光の強度は記録層の記録を劣化させない

ような強度である必要がある。

【００１２】しかし従来の方法では、再生光は隣接のトラックには影響をあたえないため、隣接トラックからの信号の漏れ込みの低減はできなかった。これに対し、本発明では隣接トラックに補助光を照射するため、再生トラックと同様の原理で隣接の記録を消しながら再生する。このため、クロストークが非常に小さな再生信号を得ることができる。

【００１３】補助光は、温度を上げるためだけに用いるため、厳密にトラックの中心に来る必要はないし、クロストークを小さくするためには、ビームスポットが再生光より大きいことが好ましい。また、補助光の中心は再生光の中心よりも若干先行した位置にある方が効率的にクロストークを削減するために好ましい。補助光は、現在コンパクトディスクのトラッキングに用いられている３ビーム法と同様に、回折格子でビームを分割する方法や、レーザーアレーを用いることで得ることができる。

【００１４】補助光の強度は、記録の消去が行え、かつ記録層の記録を劣化させないように選ぶ必要がある。レーザーに関するこういった技術は現在既に確立されたものであり、低コストで容易に実現可能である。この方法を用いれば、ドライブに巨大な初期化磁石を入れたり、交換結合力を厳密に制御しなければならないＲＡＤを用いることなく、容易にクロストークを無くすことが可能である。

【００１５】

【実施例】以下に実施例をもって本発明をさらに詳細に説明するが、本発明はその要旨を越えない限り以下の実施例に限定されるものではない。

実施例１

１．３μｍのトラックピッチを有するポリカーボネート基板上に、ＳｉＮからなる８０ｎｍの保護層、$Gd_{26}(Fe_{80}Co_{20})_{74}$（数値は成分割合）からなる３０ｎｍの再生層、$Tb_{21}(Fe_{93}Co_{7})_{79}$からなる３５ｎｍの光磁気記録層、$Gd_{28}(Fe_{93}Co_{7})_{72}$からなる１０ｎｍのスイッチング層、$Dy_{28}(Fe_{60}Co_{40})_{72}$からなる、４０ｎｍの記録層を設けた。

【００１６】この媒体を用い、線速度７ｍ／ｓで周波数９ＭＨｚの記録を１トラックに行った。また、その両側のトラックに、同一の線速で周波数３ＭＨｚの記録を行った。次に、再生ビームが３分割され、ほぼトラックと同一間隔で、トラックに垂直な方向に並んでいる再生ヘッドを用い、記録の再生を行った。この際、中心の再生光が再生トラックにあるとき、両側の補助光は隣接トラック上に存在する。３本のビームが全て２．４ｍＷのパワーであるように再生パワーを設定して再生を行った。このとき、９ＭＨｚの再生信号のＣＮＲは超解像効果のため、４６ｄＢと高い値であり、９ＭＨｚのクロストークによる信号は１１ｄＢと低い値であった。

【００１７】比較例１

実施例と同一の媒体を、通常の再生光のみの１ビームで再生を行った。再生パワーは同じく２．４ｍＷである。この場合、やはり超解像効果により、９ＭＨｚのＣＮＲは４５ｄＢと高い値を示したが、クロストークによる３ＭＨｚの信号は２７ｄＢと高い値であった。

【００１８】

【発明の効果】本発明の再生方式を用いることにより、媒体作成が簡単で、かつ初期化磁石が不要であるＦＡＤ方式を用いて、クロストークの小さい再生を行うことが可能であり、記録の高密度化が達成できる。